Turning MNT into a Microgrid

----The Detailed Building Electrical Design

Total Cost
$413704

AC Load--- HVAC
Heating&Cooling system

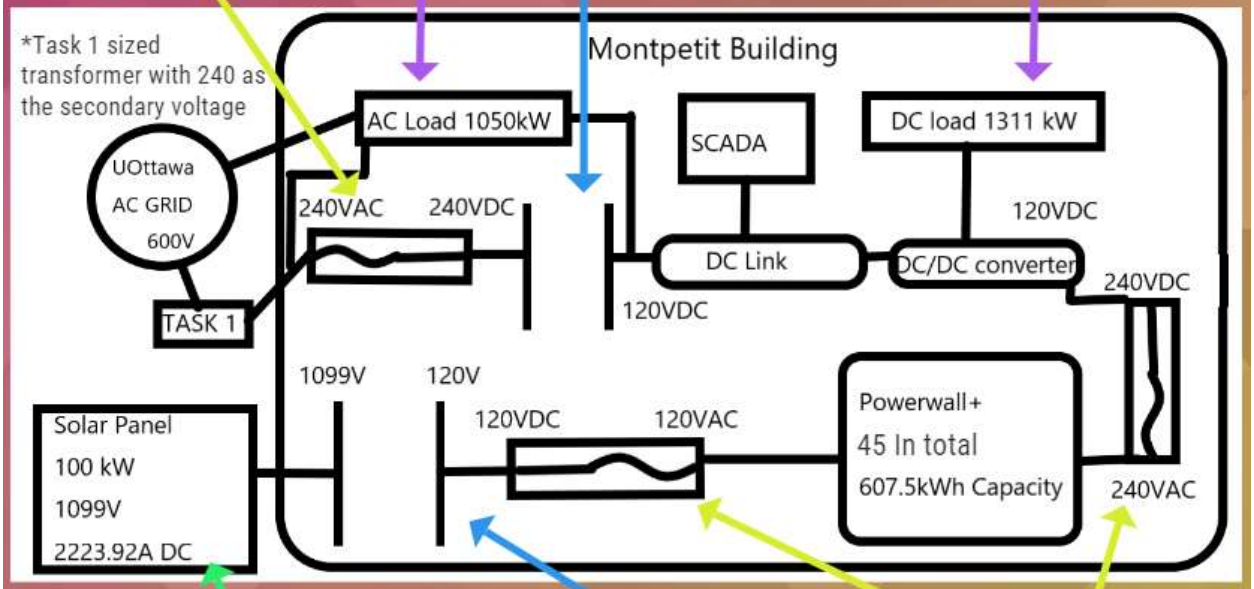
Receiving power at 240VAC and 600VAC

Every other load except HVAC

Receiving power at 120VDC

AC to DC inverter
Output Frequency:60Hz
Total Quantity: 5
Max Input current: 63A

Capacity 2kVA
Quantity needed 8



Average 6hrs of daily power generation

Annual Power output around525664kWh

Here consider total power output as 100kW(according to professor's advice)

Capacity 225kVA

Primary Voltage 2kV

Secondary Voltage 120V

Quantity needed 1

AC/DC converter

54A current

Quantity needed 5

Solar Panel output overview

Output voltage for each row (series connection)	31.4*35=1099V
Output current of each row	9.33ADC
Total output voltage	1099V
Total current output	9.33*24=223.92ADC
Total power output	1099*223.92=246.08808 kW
Hours of work daily	6 hours
Annual power output	356*6*246.08808kW=525644.138kWh
Percentage of Demand load(2361.91kW)	246.08/2361.97=0.104=10.4%

For battery storage system, consider power output as 100kW(according to professor)

Tesla Powerwall+

Nominal Battery Energy	13.5kWh
Nominal Grid Voltage(input/Output)	120/240VAC
Frequency	60Hz
Phase	3
Max Continuous current	40A
Quantity Required	45

For more info regarding powerwall+

https://tesla-cdn.thron.com/static/KBQ2AZ_Tesla_Powerwall__Datasheet_NA-EN_Y3THJT.pdf?xseo=&response-content-disposition=inline%3Bfilename%3D%22powerwall-plus-datasheet-na-en.pdf%22

To store generated energy to Powerwall+, inverters and transformers are needed for adapotion.

Transformer to convert

Capacity	225kVA
Number of Phase	3
Frequency	60Hz
Primary Voltage	2kV
Secondary Voltage	120/208V
Quantity needed	1

DC to AC inverter

Nominal Input Voltage	120V DC
Max input current	54A DC
Nominal Output Voltage	120V AC
Output Frequency	60Hz
Quantity needed	5

AC to DC inverter

Nominal Input Voltage	240V AC
Max input current	54A DC
Nominal Output Voltage	240V DC
Output Frequency	60Hz
Quantity needed	5

DC to DC converter

HVI 5K-3U7 high output voltage DC-DC converter

Input Voltage	220/230/240V DC
Output Nominal Voltage	110/120V DC
Frequency	60Hz
Efficiency	Min 85% at full load
Quantity	20

Building Load Summary（from task 1 of the lab project）

AC load	1050kW
DC load	1311kW

600Vdc Input, 500VA Industrial Quality AC-DC Sine Wave Inverter

Input Nominal Voltage	600V Dc
Input Max Current	1.3A
Output Voltage	600V Ac
Output Max Current	3.5A
Frequency	60Hz

Wall Mount Transformer, Non-Ventilated, Encapsulated Non-Ventilated, 240V, 480V, 120V, 240V, 2 kVA

Capacity	2kVA
Number of Phase	3
Frequency	60Hz
Primary Voltage	240V
Secondary Voltage	120/208V
Quantity needed	8

Financial Analysis

Wall Mount Transformer	8*571=$4568
DC to DC converter	200+20=$4000
DC-AC inverter	4074*5=$20370
AC-DC inverter	2308*5=$11540
Medium Voltage Transformer	$10976
Tesla Power Wall	4.5*80500=$362250
Total Cost	$413704